

FALL RIVER HARBOR MASSACHUSETTS

SURVEY

(REVIEW OF REPORTS)



CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION, BOSTON, MASS.

JANUARY 22, 1954

46

NOT FOR PUBLIC RELEASE

SURVEY

(REVIEW OF REPORTS)

ON

FALL RIVER HARBOR, MASSACHUSETTS

SYLLABUS

The Division Engineer has considered plans for two alternative entrance channels to Fall River Harbor. He estimates that Plan A, provision of a mid-bay channel 35-feet deep along the alignment of the former 30-foot channel, will cost \$1,540,000, with no additional navigation aids being required. He estimates that Plan B, completion of the 35-foot waterfront channel presently authorized, will cost \$846,000 in addition to costs of navigation aids. The Division Engineer finds that additional evaluated benefits accruing to the mid-bay channel exceed the additional costs. He further finds that there are other benefits, not susceptible of evaluation, that would accrue to the mid-bay channel. He therefore recommends that the existing project for Fall River Harbor, Massachusetts, be modified to the extent of providing for a channel 35 feet deep, at mean low water, generally 400 feet wide from Mount Hope Bay to Globe Wharf along the alignment of the former 30-foot mid-bay channel, the above described 35-foot channel to be accomplished in lieu of providing the authorized section of channel 35 feet deep along the Fall River waterfront between the vicinities of the Gulf Wharf and the Globe Wharf; with no change in other authorized channels and basins of

the existing project; subject to the condition that no construction work on deepening of the mid-bay channel be accomplished until local interests agree to hold and save the United States free from damages due to construction and maintenance of the additional improvement. The estimated cost to the United States of this project modification is \$694,000 for new work with \$4,000 annually for maintenance in addition to that now required.

The Division Engineer has considered a proposal to provide an anchorage 35-feet deep, south of Slades Ferry Bridge. He finds that provision of an entrance channel 35 feet deep will eliminate the need for the anchorage improvement, and therefor recommends that no project modification for this purpose be adopted at this time.

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Subject</u>	<u>Page No.</u>
1	Authority	1
3	Scope of Survey	1
4	Description	2
6	Tributary Area	3
8	Bridges	4
10	Prior Reports	6
11	Existing Project	6
14	Local Cooperation	8
15	Other Improvements	8
16	Terminal and Transfer Facilities	9
23	Improvements Desired	13
26	Commerce	14
29	Vessel Traffic	20
32	Difficulties Attending Navigation	22
34	Water Power and Other Special Subjects	23
35	Plans of Improvement	24
36	Shoreline Effects	25
37	Aids to Navigation	25
38	Estimates of First Cost	27
39	Estimates of Annual Charges	29
40	Estimates of Benefits	31
53	Comparison of Benefits and Costs	40
55	Proposed Local Cooperation	40

<u>Paragraph No.</u>	<u>Subject</u>	<u>Page No.</u>
56	Coordination With Other Agencies.	41
57	Discussion	42
68	Conclusions.	46
70	Recommendations.	47

NOT FOR PUBLIC RELEASE

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
857 COMMONWEALTH AVENUE
BOSTON 15, MASS.

January 22, 1954

SUBJECT: Review Report on Fall River Harbor, Massachusetts.

TO: The Chief of Engineers, Department of the Army, Washington
25, D.C.

AUTHORITY

1. This report on survey of Fall River Harbor, Massachusetts, is in review of previous reports, and is submitted in compliance with the following Resolution adopted July 6, 1949, by the Committee on Public Works of the House of Representatives, United States Congress:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, THAT THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS BE, AND IS HEREBY, REQUESTED TO REVIEW THE REPORTS ON FALL RIVER HARBOR, MASSACHUSETTS, SUBMITTED IN HOUSE DOCUMENT NO. 628, 79th CONGRESS, 2d SESSION, AND PRIOR REPORTS, WITH A VIEW TO DETERMINING WHETHER MODIFICATION OF THE EXISTING PROJECT IN ANY WAY IS ADVISABLE AT THIS TIME."

2. A review report of survey scope was authorized August 4, 1949 by the Chief of Engineers,

SCOPE OF SURVEY

3. In the preparation of this report, recent hydrographic surveys have been studied, and probings from various surveys have been compiled and analyzed to determine the character of the harbor bottom. Available maps, commercial statistics, and other data pertaining to the harbor have

been studied. Information obtained at a public hearing held April 30, 1953, is described in paragraphs 23-25 of this report.

DESCRIPTION

4. Fall River Harbor is located in southeastern Massachusetts about 50 miles south of Boston, 20 miles southeast of Providence River and Harbor, Rhode Island, and 13 miles northwest of New Bedford Harbor, Massachusetts. It is about 22 miles from the Atlantic Ocean through the sheltered and naturally deep waters of Narragansett and Mount Hope Bays. The harbor, comprising the mouth of the Taunton River and the head and east side of Mount Hope Bay, has a total length of about seven miles and a width varying from a maximum of about 2-1/2 miles in Mount Hope Bay to a minimum of 1,000 feet near the head end. Two highway bridges cross the harbor a short distance below its upper end. Improvements in the harbor at the present time consist of (1) the maintenance of a former 30-foot channel, 400 feet wide and approximately three miles long, from deep water in Mount Hope Bay to a point opposite Globe Wharf about one-half way up the harbor, (2) a 35-foot channel, generally 400 feet wide, widened at bends south of the bridges, extending about four miles from opposite Globe Wharf to the wharves north of the bridges, (3) a 35-foot turning basin, 1100 feet wide and 850 feet long, at the head of the channel, (4) a channel 30 feet deep and generally 300 feet wide along the Fall River waterfront and adjacent to the 35-foot channel for a distance of about one mile below the bridges, (5) a 25-foot anchorage area of 42 acres, 800 feet wide by an average length of 2300 feet, on the west side of the channel about one mile below the bridges, and (6) a 35-foot channel, 400 feet wide and about four miles

long, extending from deep water in Mount Hope Bay easterly towards the Tiverton shore then northerly along the Tiverton waterfront to the Gulf Oil Company Wharf located a short distance below the Massachusetts-Rhode Island state line. A natural channel with a controlling depth of 25 feet extends northerly for about 1.75 miles from the Gulf Oil Company Wharf to the present 35-foot channel in the upper part of the harbor. Deepening of this natural channel to a depth of 35 feet has been authorized but not accomplished to date.

5. Taunton River, entering at the upper end of Fall River Harbor, is navigable by small craft for a distance of about 11 miles to Taunton. The Sakonnet River, with natural depths of 20 to 40 feet, affords an easterly outlet to the sea from the Tiverton waterfront channel. The upper end of the harbor is well sheltered, but the lower portion is exposed to southwesterly storms which, although not hazardous to deep-draft vessels, create difficulties for small craft. The mean tidal range in Mount Hope Bay and Fall River Harbor is about 4.4 feet. The harbor is shown on U.S. Coast and Geodetic Survey Chart No. 353, and on Plate Nos. 1, 2 and 3 (File Nos. F.R. 228, 229 and 230) accompanying this report.

TRIBUTARY AREA

6. The area tributary to Fall River Harbor comprises the City of Fall River and the surrounding territory within a radius of 10 to 15 miles. In addition, petroleum products are distributed throughout a large area in central and eastern Massachusetts by means of the Fall River-Waltham-Worcester pipeline and by tank truck. The City of Fall River according to the 1950 census has a population of 111,963, while that of the metropolitan district is about 270,000. It is an important

cotton manufacturing center. Other goods manufactured in the area include rubber products, refractories, gas ranges, and brass, bronze and silver products. These industries consume large quantities of fuel for power generation. These fuels and some raw materials are brought in by water. Except for the cities of Fall River and Taunton, the immediate tributary area is primarily agricultural. It is served by a branch line of the New York, New Haven and Hartford Railroad. Good highways prevail throughout the area.

7. The area served by the petroleum pipeline with tidewater terminus at Fall River includes the Boston metropolitan district and the territory extending from Boston to some distance west of Worcester. The capacity of this line is 9,000 barrels (about 1,300 tons) per day or 3,200,000 barrels (nearly 500,000 tons) per year. The refined petroleum products are delivered to Fall River by deep-draft tankers and then piped to the Waltham and Worcester terminals, where they are distributed by truck and rail throughout the tributary area.

BRIDGES

8. The entrance to Mount Hope Bay, in the approach to the harbor, is crossed by a high-level suspension highway bridge owned by the Mount Hope Bridge Company. This bridge was completed in 1929 under plans approved by the War Department. It has a horizontal clearance of 1,156 feet and a minimum vertical clearance above mean high water of 135 feet for a width of 400 feet in the center of its span. The Sakonnet River is crossed by two bridges. The downstream bridge, known as the Old Stone Bridge, is a bascule lift highway bridge, with a horizontal clearance of 100 feet, and is on the direct route between Fall River, Massachusetts,

and Newport, Rhode Island. It will be removed upon completion by the State of Rhode Island of a new fixed highway bridge now under construction about a mile to the north and immediately south of the railroad bridge. This new bridge, being built under plans approved by the Secretary of the Army in 1953, will have a minimum vertical clearance of 65 feet in its central span of 162 feet. The railroad bridge immediately to the north has a swing span affording a clear opening of 99 feet. It is owned by the New York, New Haven and Hartford Railroad, and was completed in 1900 under plans approved by the War Department.

9. The upper portion of Fall River Harbor is crossed by two bascule highway bridges that are about 1,300 feet apart. The Slades Ferry Bridge, formerly a combined railroad and highway bridge, was rebuilt for highway use in 1938. The Brightman Street Bridge, the upper of the two bridges, was built in 1914. U.S. Route No. 6 crossing this bridge carries a large volume of traffic. Both bridges were built under plans approved by the War Department and both are now under the control of the Massachusetts Department of Public Works. Other data on these two bridges are as follows:

<u>Name</u>	<u>Owners</u>	<u>Clearances of Channel Spans (Ft.)</u>		
		<u>Horizontal</u> (feet)	<u>Vertical</u> (feet)	*
Slades Ferry	City of Fall River, et al	101	6.8	
Brightman Street	Bristol County	98	27.0	

*minimum above mean high water when closed.

The limited horizontal clearances of these bridges require large tankers of approximately 70-foot beam to use extreme caution.

PRIOR REPORTS

10. Fall River Harbor has been the subject of several preliminary examination and survey reports listed in the following tabulation. These reports, now being reviewed, form the basis of the previous and existing projects.

Prior Survey Reports on Fall River Harbor

<u>Year</u>	<u>Improvement Considered and Recommendations</u>	<u>Published In</u>
1873	Waterfront Channel - Favorable	H. Ex. Doc. 84, 43d Cong., 1st Session; Annual Report, C. of E., 1874, p. 284
1897	Entrance and Waterfront Channels - Favorable	H. Doc. 56, 55th Cong., 1st Session; Annual Report, C. of E., 1897, p. 931.
1909	Breakwater and Anchorage Favorable to Anchorage	H. Doc. 778, 61st Cong., 2d Session.
1929	30 x 400-foot Channel	H. Doc. 158, 71st Cong., 2d Session.
1945	35 x 400-foot Waterfront Channel - Favorable	H. Doc. 628, 79th Cong., 2d Session.

EXISTING PROJECT

11. The original project, authorized in 1874 and completed in 1878, consisted of a channel 12 feet deep for about 1,500 feet along the waterfront of the city. In 1899, dimensions of 25 feet by 300 feet were authorized for a waterfront channel, followed by an authorization in 1902 for an entrance channel of the same dimensions through Mount Hope Bay. These improvements were completed in 1907. The 25-foot anchorage was authorized in 1910 and completed in 1913. The costs prior to adoption of the existing project were \$330,204.16 for new work and \$81,410.31 for maintenance, a total of \$411,614.47.

12. The existing project, based on the reports of 1929 and 1945, was authorized by the River and Harbor Acts of July 3, 1930 and July 24, 1946. It provides for a channel 35 feet deep and 400 feet wide, with increased width at bends, from deep water in Mount Hope Bay easterly into Tiverton Lower Pool, and to the vicinity of the existing Tiverton oil terminals east thereof, thence northerly along the Tiverton waterfront and through Fall River Harbor to the wharves above the bridges; and a 35-foot turning basin, about 1,100 feet wide and 850 feet long, between the Shell and Montaup Wharves at the upper end of the channel. Abandonment of the existing 30-foot straight outer channel, or mid-bay channel, extending from deep water in Mount Hope Bay to the bend opposite Globe Wharf was enacted by Congress in 1946 at the time of approval of the 35-foot channel. The existing project also provides for a channel 30 feet deep and generally 300 feet wide extending about one mile below Slades Ferry Bridge; for removal to a depth of 30 feet the lower end of Hog Island Shoal, located about one mile south of Mount Hope Bridge; and for the maintenance of the 25-foot anchorage and adjacent triangular area of the former 30-foot channel, a total area of about 52 acres, west of the harbor channel and about one mile south of Slades Ferry Bridge.

13. The project has been completed except for (1) the removal of ledge rock shoals along the edge of the 35-foot channel in the vicinity of the bridges, (2) dredging the 1.75 mile reach of the 35-foot channel extending from Gulf Wharf to Globe Wharf, and (3) the removal of a small amount of rock at Hog Island Shoal. The costs to date under the existing project have been \$2,496,831.26 for new work and \$313,106.56 for maintenance, a total of \$2,809,937.82. The latest (1950) approved estimate for annual cost of maintenance is \$30,000. Actual maintenance costs for

the past ten years have averaged approximately \$25,000 a year but this figure reflects no maintenance work in the 35-foot channel. In view of the increase in price levels in recent years, the latest approved estimate is considered to be inadequate at this time. The annual cost of maintenance of the authorized project is currently estimated (1954) at \$36,000.

LOCAL COOPERATION

14. The project modification adopted in 1946 required that local interests furnish free of cost to the United States all lands, easements and rights-of-way necessary for construction of the project, and suitable spoil areas as and when required for the initial work and subsequent maintenance. These requirements have been met and spoil disposal areas have been furnished for the initial dredging of the project to the extent presently accomplished.

OTHER IMPROVEMENTS

15. The Commonwealth of Massachusetts has expended about \$1,500,000 in the past several years on the construction of a pier and storage terminal in Fall River Harbor. Including the costs of land acquisition and remaining construction, the total expenditures by the Commonwealth are expected to total about \$2,000,000 on this improvement.

TERMINAL AND TRANSFER FACILITIES

16. The total water frontage of the harbor on the east side of Mount Hope Bay is about eight miles of which 2.5 miles are in the town of Tiverton, Rhode Island, adjoining Fall River on the south. The frontage on the west side of the harbor totals about three miles, all in the town of Somerset, Massachusetts. There are 20 piers, wharves, and docks in operation in Fall River Harbor. Of these, eight piers are available for deep-draft vessels, three in Tiverton, three in the central section of Fall River Harbor and two at the upper end of the harbor, above the bridges. These piers are adequate to handle the volume of deep-draft traffic utilizing the harbor.

17. The Tiverton section of the harbor is devoted to large petroleum terminals of the Bay Oil Corporation, the Pacific Oil Company, and the Gulf Oil Corporation. The total berthing space at each of these piers equals 700 feet, 500 feet and 426 feet respectively, with depths of 34 and 35 feet at mean low water. Rail connections serve each terminal. These terminals have storage capacities of 495,000 barrels, 327,000 barrels, and 350,000 barrels respectively. Additional storage capacity of 1,050,000 barrels is under construction at the Bay Oil Company tank farm. The entire facilities of this company are being acquired by the U. S. Air Force.

18. The three deep-draft terminals in the central portion of Fall River Harbor include a terminal owned and operated by the Firestone Industrial Products Company, a modern pier known as the State Pier which is operated by the city of Fall River and the Pacific Oil Company pier. A brief discussion of each follows:

a. The Firestone Industrial Products Company pier is located nearly opposite the Borden Flats Light. It provides berthing space

of 1574 feet with depths up to 26 feet at mean low water. This pier is utilized for the receipt of latex and fuel oil.

b. The State Pier is situated about one mile below the Slades Ferry Bridge. It is the only deep-draft terminal in the port open to the public and designed for handling general cargo. It provides a berthing space of 1,380 feet with depths up to 35 feet at mean low water. The upper side of the pier is occupied by a freight shed with dual rail sidings. The lower side of the pier will accommodate a 600-foot by 160-foot steel frame transit shed for storing and assembling general cargo. This shed is presently under construction. The pier will provide modern handling equipment and necessary services. Open storage space totals 150,000 square feet.

19. A short distance north of the State Pier, the Pacific Oil Company operates the pier formerly known as the Atwater Fuel Wharf. This pier is used for the receipt of petroleum products and provides berthage 700 feet long, with a depth of 35 feet. Oil storage capacity is 49,619 barrels.

20. The two deep-draft terminals situated above the bridges consist of the Shell Oil Company terminal on the Fall River side and the Montaup Electric Company pier on the Somerset side. The Shell Oil terminal has berthing space of 900 feet with a present depth of 30 feet at mean low water. A tank farm provides storage for 1,250,000 barrels of petroleum products. A petroleum pipeline with an annual capacity of about 500,000 tons is operated by the company between Fall River, Metropolitan Boston and Worcester.

21. The Montaup Electric Company pier provides terminal facilities to handle the fuel requirements of a large steam electric power installation with 210,000 kw of installed capacity. Berthing space totals 610 feet

with depths of 30 feet at mean low water. Equipment includes an electric traveling coal hoist with three-ton bucket, an inclosed conveyor system to storage area and plant, and one eight inch pipe line extending to oil storage tanks. Storage capacity is available for 104,000 barrels of liquid fuel and 150,000 tons of solid fuel.

22. Pertinent information with respect to other terminal and transfer facilities in Fall River Harbor is contained in the table on the following page.

FALL RIVER HARBOR
TERMINAL FACILITIES WITH BERTHING DEPTH
LESS THAN 25 FEET BELOW MEAN LOW WATER

<u>Pier, Wharf or Dock</u>	<u>Berthing Space</u>		<u>Use</u>	<u>Remarks</u>
	<u>Length</u> (feet)	<u>Depth</u> (feet)		
Fall River Gas Works Co.	200	0 to 13	Petroleum products	Storage tank capacity 20,000 bbl. Mechanical facilities for handling coal.
Petroleum Terminal Corp.	200	15	Petroleum products	Storage tank capacity 5,795 bbl.
Texas Co. and Atlantic Refining Co.	180	20	Petroleum products	Storage tank capacity 13,210 bbl.
Globe Wharf (Staples Oil Co.)	745	8 to 23	Coal and bunkering	Storage space for 25,000 tons of coal. Mechanical facilities for handling coal. Railway siding.
Tide Water Associated Oil Co.	200	15 to 18	Petroleum products	Storage tank capacity 40,000 bbl.
Fall River City Pier	535	1 to 16	Bulk cargo	Open storage space of 25,000 sq.ft.
Joseph A. Bowen Co.	513	4 to 18	Receipt of petroleum products and mooring floating equipment	Storage tank capacity 14,571 bbl.
Rodman Wharf (Staples Coal Co.)	1,200	0 to 15	Mooring vessels	Wharf is occupied by four two-story brick buildings formerly used for handling coal.
City Pier	805	4 to 12	Mooring floating equipment and recreational craft	
Fall River Electric Light Co.	627	2 to 15	Petroleum products	Storage tank capacity 48,400 bbl.
Somerset Boat Co.	240	0 to 10	Boat servicing and repair	Marine railways and repair shop
U.S. Naval Reserve (City of Fall River)	240	0 to 9	Mooring vessels	Training Building

IMPROVEMENTS DESIRED

23. A public hearing held at Fall River on April 30, 1953, was attended by 50 people; and communications were received from about 15 others. These included United States Senators and Representatives from Massachusetts and Rhode Island, representatives of the U.S. Navy and U.S. Coast Guard, the Governors and other officials of both States, officials of the adjoining municipalities of Fall River and Tiverton, spokesmen for the Fall River Chamber of Commerce, and representatives of the oil companies, shippers, local industries, navigation interests, and pilots. The City of Fall River requested reconsideration of the 30-foot mid-bay entrance channel abandoned by the latest project modification in 1946, and its improvement by dredging to a depth of 35 feet. The proponents claimed that the straight mid-bay channel would be safer, easier and more economical to navigate. Most of the shippers, ship operators, and pilots present stated that the several reaches of the waterfront channel, sharp turning angles, and the proximity of the channel to the shore, make the waterfront channel hazardous as compared to the straight mid-bay channel. The proponents of the mid-bay channel also claimed that the direction of tidal flow makes navigation more difficult along the waterfront channel, and that this channel would be subject to freezing or blockage by ice. City officials considered unlikely further industrial development of the Fall River waterfront adjacent to the incompletd channel section due to the steepness of the shore in that area.

24. The opponents of the proposed project modification expressed their concern that restoration and improvement of the mid-bay channel would lead to the abandonment of the completed section of the waterfront

channel to Gulf Wharf. The opponents believe that the waterfront channel could be completed at half the cost of improving the mid-bay channel, and indicate doubt as to availability of spoil disposal areas for the volumes of material necessary to be dredged from the mid-bay channel. The opponents further claim that termination of the waterfront channel just north of Gulf Wharf would require provision of a turning basin near the Rhode Island-Massachusetts state line. They cite in support of completion of the waterfront channel the possible development of through navigation in Sakonnet River.

25. A further modification of the project proposed by local pilots would provide for an anchorage 35 feet deep about one mile south of the bridges crossing the upper harbor. The pilots stated that the bridges were restrictive and hazardous for night navigation. They stated that provision of an anchorage immediately below the bridges would enable more advantageous use of daylight in navigating the bridge openings.

COMMERCE

26. The commerce of Fall River Harbor has increased gradually since World War II, the average annual increase being about six per cent. The principal commodities are coal and petroleum which constitute over 98 per cent of the total commerce. The total tonnages handled during the past 10 years and a breakdown of the commerce in 1952, the latest year for which records are available, are summarized in the following tabulations:

Commerce -- Fall River Harbor, Massachusetts
(including Tiverton R.I. oil terminals)

<u>Year</u>	<u>Freight Traffic</u> (In short tons)	<u>Passengers</u>	<u>Through Traffic</u> (In short tons)
1943	699,614 *	—	996
1944	873,298 *	—	177
1945	1,070,030 *	—	—
1946	1,307,967	—	—
1947	1,345,070	—	24,385
1948	1,630,905	7,147	328,714
1949	1,334,537	3,611	26,224
1950	1,667,835	8,842	—
1951	1,750,145	11,793	—
1952	1,876,643	11,424	—

*Reflect the restriction of coastwise commerce during the war.

Freight Traffic, 1952
(In short tons)

<u>Commodity</u>	<u>Total</u>	<u>Foreign Imports</u>	<u>Domestic</u>				<u>Local</u>
			<u>Coastwise</u>	<u>Shipments</u>	<u>Internal</u>	<u>Shipments</u>	
			<u>Receipts</u>		<u>Receipts</u>		
Rubber, crude	13,399	13,399	—	—	—	—	—
Logs	99	99	—	—	—	—	—
Bituminous coal	176,952	—	176,952	—	—	—	—
Petroleum products	1,672,991	321,994	1,206,597 (1)	78,458	49,706	9,243	6,993
Industrial chemicals	11,880	—	9,466	2,414	—	—	—
Fertilizer	705	—	705	—	—	—	—
Miscellaneous	17	—	—	—	—	—	17
TOTALS	1,876,643	336,092	1,393,720 (1)	80,872	49,706	9,243	7,010

(1) In addition 94,160 tons of petroleum received at Tiverton in 12 deep-draft naval tank ships.

1952 DEEP-DRAFT COMMERCE BY PORT AREA (2)
(Receipts in short tons)

Port Area	Commod- ity*	Draft in Feet								Total Tonnage
		<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>		
Tiverton Waterfront (to State line)	P	—	—	—	24,289	112,429	70,105	—		206,823 (1)
Fall River South Waterfront (South of Globe Wharf)	P	—	—	—	—	—	17,375	—		17,375
Fall River Central Waterfront (Globe Wharf to Slades Ferry Bridge)	C	7,456	14,921	7,516	—	—	—	—	29,893	
	L	—	—	—	1,750	4,125	7,000	—	<u>12,875</u>	42,768
Fall River Upper Harbor (north of Slades Ferry Bridge)	P	128,600	46,250	22,666	108,925	331,101	330,500	36,183	1,004,225	
	C	7,454	—	—	75,937	46,730	—	—	<u>130,121</u>	1,134,346
<hr/>										
TOTALS	P	128,600	46,250	22,666	133,214	443,530	417,980	36,183		1,228,423
	C	14,910	14,921	7,516	75,937	46,730	—	—		160,014
	L	—	—	—	1,750	4,125	7,000	—		12,875
		<u>143,510</u>	<u>61,171</u>	<u>30,182</u>	<u>210,901</u>	<u>494,385</u>	<u>424,980</u>	<u>36,183</u>		1,401,312 (1)(2)

* P - Petroleum
C - Coal
L - Latex

- (1) In addition, 94,160 tons of petroleum received at Tiverton in 12 deep-draft naval tank ships.
(2) In addition approximately 330,000 tons received in vessels with loaded drafts of less than 26 feet.

27. Approximately 90 percent of the present port commerce is in petroleum products. Based on past records of the use of petroleum in Massachusetts, and statistical data on future demands, it is conservatively estimated that the use of petroleum over the life of the project would average 50 percent greater than present volumes. This estimate, includes full allowance for the effect of the introduction of natural gas to the area in 1953. Natural gas is mixed with manufactured gas and its use principally affects the consumption of bituminous coal. The estimate of percentage growth in petroleum commerce, however, is based on allocating the effect of use of natural gas in direct proportion to previous usage of other fuels. Present plans and initial construction of natural gas pipelines by the industry represent a shift of approximately 15 percent from the present fuel consumption pattern. If New England eventually should reach the national average for use of natural gas, this shift from present usage would equal 20 percent. For the purposes of this report an average of the above two estimates is used, and it is assumed that natural gas will replace about 17.5 percent of the fuel oil use otherwise obtaining in Massachusetts. As about 25 percent of the present petroleum commerce in Fall River Harbor is in gasoline and motor fuels that would be unaffected by the use of natural gas, the percentage effect on future total petroleum use would be a reduction of about 13 percent. The net result is an anticipated future average petroleum commerce in the harbor approximately 50 percent in excess of present volumes.

28. The construction of the State Pier is now nearing completion. This modern terminal should encourage general cargo traffic in the port.

In view of the many factors involved, and lack of the necessary period of experience to measure the effect of the new facilities, no estimate of increase in future dry cargo commerce is included in this report.

VESSEL TRAFFIC

29. A tabulation of commercial vessel traffic for 1946-1952, inclusive, follows:

Trips and drafts of vessels (including Tiverton, Rhode Island oil terminals)							
Draft (in ft.)	1946	1947	1948	1949	1950	1951	1952 (1)
33	--	--	--	--	1	--	--
32	--	--	--	2	3	3	2
31		} 9	10	9	24	26	36
30	27		22	28	29	33	33
29		} 31	3	9	7	14	13
28			10	5	3	9	6
27	} 15	} 7	3	5	7	3	11
26			4	5	12	15	17
Under 25	950	813	1960	1317	1714	1615	1916
Totals	992	860	2012	1380	1800	1718	2034

(1) Exclusive of 12 deep-draft naval tank ships

30. The trend to deeper draft ships is apparent. In the period 1946-1952, inclusive, in which the volume of commerce increased about 45 percent, there was an increase of over 160 percent in number of ships with drafts in excess of 30 feet, and an increase of over 230 percent in the number of those with drafts in excess of 28 feet.

31. The deep-draft vessel traffic for 1952, by port areas, is indicated below:

<u>VESSEL TRIPS - 1952</u>								
<u>DRAFT IN FEET</u>								
<u>Port Area</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>	<u>Total Trips</u>
Tiverton Waterfront (to State line)	1	-	-	3	7	5	-	16 (1)
Fall River South Waterfront (south of Globe Wharf)	-	-	-	-	-	1	-	1
Fall River Central Waterfront (Globe Wharf to Slades Ferry Bridge)	-	3	1	2	5	8	-	19
Fall River Upper Harbor (north of Bridges)	16	8	5	8	21	22	2	82
Total	17	11	6	13	33	36	2	118 (1)

(1) Exclusive of 12 deep-draft naval tank ships)

CULTIES ATTENDING NAVIGATION

32. The authorized 35-foot channel ~~project~~ terminates just north of the Gulf Wharf in Tiverton. About 1.75 miles of this channel along the southern waterfront of Fall River, from the Gulf Oil Company wharf in Tiverton to Globe Wharf in Fall River, has not been dredged. (See paragraphs 12 and 13). At the present time there is a controlling depth of about 25 feet in this unimproved length of channel connecting the completed portion of the authorized 35-foot channel opposite the Tiverton waterfront with the completed portion of the 35-foot channel opposite Globe Wharf. Although pilots have stated that ships of 30-foot draft have navigated this reach of channel at high water, in general all vessels destined to wharves in the central and upper areas of Fall River Harbor use the formerly authorized entrance channel, or mid-bay channel, which is being maintained to a 30-foot depth pending completion of the 35-foot project. A preponderance of the local pilots state that the waterfront channel, following authorized project alignment, is a more difficult and hazardous entrance to Fall River Harbor than the mid-bay channel which they now use. They cite the following factors in favor of the mid-bay channel; (1) six courses are required in navigating the waterfront channel as compared with two nearly aligned reaches in the mid-bay channel, (2) sharp turning angles must be made in navigating the waterfront channel, none in the mid-bay channel, (3) dangerous operating conditions due to the proximity of the waterfront channel to a steep shore, (4) the reach at the entrance to the waterfront channel runs nearly normal to the direction of tidal flow thereby creating a hazard to passing ships especially when both are using the same channel quarter to overcome the set of the tide, and (5) the greater probability of the waterfront channel being

blocked by ice.

33. The pilots and shippers using Fall River Harbor also state that the bridges crossing the upper harbor are unduly restrictive and hazardous to navigation. These bridges, with horizontal clearances of 98 feet and 101 feet, are not quite parallel and their draws are not in line with the direction of the channel, one draw being offset nearly 100 feet. It is claimed that the difficulty in navigating through the bridges prevents night navigation above that point. This is the reason given for the need of a 35-foot anchorage below the bridges.

WATER POWER AND OTHER SPECIAL SUBJECTS

34. There are no matters of flood control or water power pertinent to this report. The disposal of hydraulically dredged material in waters adjacent to Spar Island during the 35-foot channel dredging aroused protests from shellfish interests. However the town of Tiverton and the State of Rhode Island, rejecting the objections of fishing interests, granted permits for the disposal of dredged material in these waters. The taking of shellfish from Mount Hope Bay is prohibited by law due to pollution. The use of this area for future disposal of dredged material is undesirable as investigations carried out during recent operations indicated extensive displacement by tidal action with consequent potential damage to navigable channels. The State of Rhode Island has indicated doubt as to the availability of disposal areas of sufficient capacity

in Rhode Island waters for the proposed dredging of the mid-bay channel. No suitable areas exist in Massachusetts. It is concluded therefore that future dredging should be predicated on the use of bucket dredges with disposal in the public dumping grounds in Narragansett Bay.

PLANS OF IMPROVEMENT

35. The plan of improvement found most practicable for Fall River Harbor provides, in addition to the work completed on the existing project, for the dredging of a mid-bay entrance channel, 35 feet deep, 400 feet wide, and approximately 3.5 miles long from deep water in Mount Hope Bay to the completed portion of the 35-foot channel off Globe Wharf. This channel, affording the most direct and convenient access to the wharves in the central and upper portions of Fall River Harbor which received over 80 percent of the deep-draft commerce in 1952 would follow the alignment of the previously authorized 30-foot channel that was abandoned by the River and Harbor Act of 1946. An alternative proposal has been considered which provides for a 35-foot entrance channel to the upper harbor through completion of the existing project for Fall River Harbor. This would entail dredging to a depth of 35 feet the presently unimproved reach of about 1.75 miles between the Gulf Oil Company Wharf in Tiverton, Rhode Island, and Globe Wharf in Fall River, Massachusetts. The relative difficulties in navigating the authorized waterfront channel as compared with the mid-bay channel are discussed in paragraph 32. Consideration has also been given to the need and desirability of providing a 35-foot anchorage area of about 52 acres on the west side of the main channel about one mile below Slades Ferry Bridge. This anchorage would be obtained by deepening the present 25-foot anchorage covering 42 acres and the adjoining trian-

gular area of the former 30-foot channel covering about 10 acres. The 35-foot depths in the two considered entrance channels and in the anchorage are referenced to the plane of mean low water and do not include two feet of overdepth dredging which has been allowed in the determination of cost estimates. None of the considered improvements involve any modifications to existing bridges.

SHORELINE EFFECTS

36. The considered improvements consist of modifications in the depth of improved or natural channels and an improved anchorage area, and would have no effect on the configuration of the adjacent shoreline.

AIDS TO NAVIGATION

37. The United States Coast Guard have been consulted in regard to necessary aids to navigation and have furnished the following estimates of cost based on prices current in January 1954:

	<u>First Cost</u>	<u>Annual Maintenance</u>
a. Existing buoys in mid-bay channel below Globe Wharf.	\$ 28,241	\$ 2,440
b. Existing buoys in completed section of authorized 35-foot channel, below Gulf Oil Co. Wharf.	17,373	1,780
c. Additional buoys required for authorized 35-foot channel, from Gulf Oil Co. Wharf to Globe Wharf.	<u>10,000</u>	<u>780</u>
d. Total for authorized 35-foot channel, below Globe Wharf. (Sum of b. and c. above)	\$ 27,373	\$ 2,560
e. Additional buoys for 35-foot anchorage in upper harbor.	None	None

The above estimates are predicated on the assumption that there were no buoys in lower Fall River Harbor. They were obtained in order to afford a comparison of the **total costs** of buoying the two considered channel layouts. The only considered improvement entailing additional cost for buoys would be the one providing for the completion of the 35-foot channel from the Gulf Oil Company Wharf to Globe Wharf (item c. above). At the present time both the completed portion of the 35-foot channel along the Tiverton waterfront and the former 30-foot mid-bay channel are buoyed.

ESTIMATES OF FIRST COST

38. Estimates of cost have been prepared for the two alternative entrance channels herein considered, and for the proposed anchorage. The estimates for the channels include the costs of the completed sections. Dredging quantities are in terms of place measurement and provide for dredging ordinary material to the proposed project depth of 35 feet plus allowances for two feet of overdepth and side slopes of one vertical on three horizontal. The unit prices on completed work are the actual costs that have been incurred. The unit prices on new work are based on prices prevailing in January 1954 and on removal of material by contract dredging, using a bucket dredge, with disposal of dredged material in deep water at the public dumping ground in lower Narragansett Bay. The estimated costs of the various considered improvements include allowances for contingencies and engineering, inspection, and overhead. These estimated costs are set forth below:

a. Estimated Cost of 35-foot Channel, Mount Hope Bay to Head of Project, via Mid-Bay Channel. (Plan A).

(1) Mid-Bay Channel, Mount Hope Bay to Globe Wharf.

(a)	Corps of Engineers; - Dredging 1,500,000 cubic yards at about \$1.03 -----	\$1,540,000
(b)	U.S. Coast Guard; - Aids to navigation(*)	<u>28,000</u>
	Sub-total	\$1,568,000

* Estimated current cost of installation of existing buoys, included for comparison purposes only. No actual cost for aids to navigation would be involved if the channel is improved, as the aids now marking the 30-foot channel would serve the 35-foot channel.

(2) <u>Completed portion of 35-foot channel north of Globe Wharf. (Actual costs; includes funds that have been allotted for removal in 1954 of rock in vicinity of bridges):</u>	
(a) Corps of Engineers	\$ 738,000
(b) U.S. Coast Guard	<u>None</u>
Sub-total	\$ 738,000
Total via Plan A	\$ 2,306,000
b. <u>Estimated Cost of 35-foot Channel from Gulf Oil Co. Wharf, Tiverton, Rhode Island, to Head of Project (Plan B).</u>	
(1) <u>Waterfront Channel, Gulf Wharf to Globe Wharf</u>	
(a) Corps of Engineers: - Dredging 775,000 cubic yards at about \$1.10-----	846,000
(b) U.S. Coast Guard: - Aids to navigation-----	<u>10,000</u>
Sub-total	\$ 856,000
(2) <u>Completed portion of 35-foot channel north of Globe Wharf. (Same as a(2), above)-----</u>	<u>738,000</u>
Total via Plan B	\$ 1,594,000
c. <u>Actual Cost of Completed 35-foot channel, Mount Hope Bay to Tiverton waterfront.</u>	
(1) Corps of Engineers-----	\$ 1,462,000
(2) U.S. Coast Guard-----	<u>17,000</u>
Total	\$ 1,479,000
d. <u>Estimated Cost of 35-foot Anchorage.</u>	
(1) Corps of Engineers: Dredging 1,400,000 cubic yards at about \$1.03-----	\$ 1,436,000
(2) U.S. Coast Guard-----	<u>None</u>
Total	\$ 1,436,000

ESTIMATES OF ANNUAL CHARGES

39. The estimated annual carrying charges have been computed on an assumed project life of 50 years and at an interest rate of 2.5 per cent. All costs and charges are Federal. They are summarized below.

SUMMARY OF FIRST COSTS AND ANNUAL CHARGES

	<u>PLAN A</u>		
	<u>Proposed Work</u>	<u>Completed Work</u>	<u>Total Project</u>
1. <u>Investment</u>			
a. Construction(Corps Engrs.)	\$1,540,000	\$ 738,000	\$2,278,000
b. Aids to Navigation (Coast Guard)	<u>28,000</u>	<u>None</u>	<u>28,000</u>
c. Total	\$1,568,000	\$ 738,000	\$2,306,000
2. <u>Annual Carrying Charges</u>			
a. Interest	39,200	18,400	57,600
b. Amortization	16,100	7,600	23,700
c. Additional maintenance	5,000	2,000	7,000
d. Maint. of aids to navigation	<u>2,400</u>	<u>None</u>	<u>2,400</u>
e. Total	\$ 62,700	\$ 28,000	\$ 90,700

<u>PLAN B</u>			
	<u>Proposed Work</u>	<u>Completed Work</u>	<u>Total Project</u>
1. <u>Investment</u>			
a. Construction (Corps Engrs.)	\$ 846,000	\$ 738,000	\$1,584,000
b. Aids to Navigation (Coast Guard)	<u>10,000</u>	<u>None</u>	<u>10,000</u>
c. Total	\$ 856,000	\$ 738,000	\$1,594,000
2. <u>Annual Carrying Charges</u>			
a. Interest	\$ 21,400	\$ 18,400	\$ 39,800
b. Amortization	8,800	7,600	16,400
c. Additional Maintenance	1,000	2,000	3,000
d. Maint. of aids to navigation	<u>800</u>	<u>None</u>	<u>800</u>
e. Total	\$ 32,000	\$ 28,000	\$ 60,000

Tiverton Channel
(Completed)

1. <u>Investment</u>	
a. Construction (Corps Engrs.)	1,462,000
b. Aids to Navigation (Coast Guard)	<u>17,000</u>
c. Total	1,479,000
2. <u>Annual Carrying Charges</u>	
a. Interest	37,000
b. Amortization	15,200
c. Additional maintenance	3,000
d. Maint. of aids to navigation	<u>1,800</u>
e. Total	57,000

35-Foot Anchorage
(Proposed Work)

1. Investment

a. Construction (Corps Engrs.)	1,436,000
b. Aids to Navigation (Coast Guard)	<u>None</u>
c. Total	1,436,000

2. Annual Carrying Charges

a. Interest	35,900
b. Amortization	14,700
c. Additional maintenance	5,000
d. Maint. of aids to navigation	<u>None</u>
e. Total	55,600

ESTIMATES OF BENEFITS

40. The principal improvement of Fall River Harbor under consideration is the provision of an entrance channel, 35 feet deep and 400 feet wide, leading to the upper harbor. Two alternative locations are considered, each of which would benefit deep-draft shipping to the central and upper harbor by elimination of tidal delays now encountered in using the 30-foot mid-bay entrance channel. Deep-draft traffic to the upper harbor does not now move via the waterfront channel because of the controlling depths of 25 feet in the incompletd 1.75 mile reach of channel south of Globe Wharf. An estimate of the relative benefits that would be realized by either of these channels rests therefor upon an economic analysis of the factors affecting them.

41. The principal difference between the two channel routes lies in the ease and safety of navigation over the mid-bay channel. There is no record available of monetary damage or loss from use of that

section of the waterfront channel below the Gulf Wharf in Tiverton that was completed in 1949-1950. The views of the local pilots and shippers that the waterfront channel would require an extra 0.5 hour each way is considered reasonable. It is considered probable that use of tugs would be required for navigation of the waterfront channel in fog, bad weather, or at night. This latter factor would affect shipping only to the central harbor area as traffic to the upper harbor is equally or more severely affected by the restricted clearances of existing bridges.

42. The deep-draft ships affected are bulk cargo vessels carrying crude rubber, coal, and petroleum. Estimates of benefits are based on deep-draft vessel traffic in 1952 modified to reflect an anticipated average increase of 50 percent in petroleum tonnage over the life of the project. (See paragraph 27). The benefits consist of savings in transportation costs by reduction of ship operating time, elimination of towing charges, and elimination of underloading. The benefits are adjusted to reflect their real values prevailing over the life of the project, relative to the project costs.

43. Studies have been made of the tidal fluctuations in Fall River Harbor and of channel depths required to afford necessary allowances for (1) ship draft, (2) sinkage or squat underway, (3) uneven loading, and (4) clearance under the keel for navigability and to avoid sheering. These studies show that delays now caused by awaiting tide may be reduced or eliminated to the extents shown in the following tables. The hourly costs shown therein are adjusted for future real values of the benefits rela-

tive to project costs, and reflect the total adjusted benefit to be realized. The number of trips reflect an estimated 50 percent increase in petroleum tonnage.

TIDAL DELAYS
 Central Fall River Harbor
 (Globe Wharf to Slades Ferry Bridge)

<u>Tankers</u>				<u>Colliers and C-2 Cargo Ships</u>		
Draft	No.	Av. Reduction in Delay in Hrs.	Total Delay	No.	Av. Reduction in Delay in Hrs.	Total Delay
26	-	-	-	-	-	-
27	-	-	-	3	1.7	5.1
28	-	-	-	1	2.2	2.7
29	-	-	-	2	4.4	8.8
30	-	-	-	5	4.4	22.0
<u>31</u>	<u>1</u>	<u>3.6</u>	<u>3.6</u>	<u>8</u>	<u>3.6</u>	<u>28.8</u>
Total	1		3.6	19		67.4

Tankers:-
 3.6 hrs at \$170/hr
 \$ 600

Colliers and C-2 Cargo Ships:-
 67.4 hrs at \$120/hr

8,100

\$8,700

Upper Fall River Harbor
(Above the bridges)

Draft	No.	<u>Tankers</u>		No.	<u>Colliers</u>	
		Av. Reduction in Delay in Hrs.	Total Delay		Av. Reduction in Delay in Hrs.	Total Delay
26	22	1.0	22.0	1	1.0	1.0
27	12	2.0	24.0	-	-	-
28	4	2.6	10.4	2	2.6	5.2
29	3	4.9	14.7	6	4.9	29.4
30	25	4.9	122.5	4	4.9	19.6
31	33	3.9	128.7	-	-	-
32	3	2.9	8.7	-	-	-
Total	102		331.0	13		55.2

Tankers: - 331.0 hrs at \$170/hr \$56,300

Colliers:- 55.2 hrs at \$120/hr 6,600
\$62,900

44. Statistics on vessel traffic indicate that over 70 percent of the future deep-draft vessels entering the harbor, assuming the harbor is maintained at its present 30-foot status, will be drawing water in excess of drafts that permit safe navigation and normal harbor speeds at the higher stages of the tide. The vessels which do exceed safe drafts must proceed more slowly up the harbor, those with maximum draft proceeding at a minimum speed. A channel 35-foot deep will permit vessels drawing 29 to 30 feet to maintain normal operating speed at all times. Vessels of greater draft will be able to enter safely at normal speed after awaiting a one- to two-foot rise in the tide. It is estimated that elimination of the necessity for vessels exceeding a 29-foot draft

to run at below normal navigating speeds, even at high water, will save transit time in amounts of up to a maximum of one-half hour for a vessel of 32-foot draft. It is estimated that the annual benefit from reduction in transit time, creditable to a 35-foot project, amounts to \$2,600.

45. The 1952 commercial statistics show approximately 40 percent of the tanker traffic to the upper harbor entering less than fully loaded. Those ships that do enter fully loaded must wait for the highest tidal stages and proceed up the harbor at drastically reduced speed. Under these conditions, they have a dangerously inadequate clearance under their keel. Ships entering less than fully loaded have adequate clearance under the ship and suffer less tidal delay, as noted in the previous paragraph. However, the reduction of losses from tidal delay is effected at the additional expense created by delivering partial loads per trip. Elimination of this loss from underloading will be possible with a channel 35 feet deep. The net benefit, adjusted to take into account the effect of tidal delays, has been estimated to average \$0.08 per ton based on an average price level over the life of the project. The average annual tonnage that would be so affected is estimated as 590,000 tons based on loading conditions experienced in 1952. The total net benefit is:

$$590,000 \text{ tons} \times \$0.08 = \$47,200$$

46. Deep-draft vessels destined to wharves in upper Fall River Harbor require the assistance of tugs at all times in order to navigate the bridge openings. This is irrespective of the location of the entrance channel. Large vessels destined to central Fall River Harbor via the waterfront channel would require the assistance of two tugs in periods of fog, bad weather, and darkness. This service would not be required under like circumstances if the mid-bay entrance channel

were available. It is estimated that 14 vessels a year, or about two-thirds of the deep-draft ships destined to the central harbor, would benefit from savings in the cost of towing service through use of the mid-bay entrance. The total annual benefit from elimination of this cost is as follows:

$$14 \text{ round trips at } \$700 = \$9,800$$

Use of the waterfront channel would require an additional half-hour transit time each way for all deep-draft ships to and from central and upper Fall River Harbor. The number of such trips is estimated at 117 a year based on 1952 statistics and allowing for an increase of 50 percent in commerce over the life of the project. This additional cost through use of the waterfront channel is estimated as follows:

<u>Central Harbor</u>	<u>Upper Harbor</u>
1 tanker x 1.0 hr x \$170 = \$ 200	84 tankers x 1.0 hr x \$170 = \$14,300
19 colliers and C-2 ships x 1.0 hr x \$120 = <u>2,300</u> \$2,500	13 colliers and C-2 ships x 1.0 hr x \$120 = <u>1,600</u> \$15,900

47. In addition to the benefits evaluated above that would be realized by use of the mid-bay channel, but not by use of the waterfront channel, there are other benefits due to the difference in ease and safety of navigating the two channels. Approximately 117 trips each way of deep-draft vessels are concerned. While conditions make impracticable a firm monetary evaluation of the benefits due to ease and safety of navigating the mid-bay channel, above and beyond those benefits estimated in the previous paragraph, in the best judgment of the reporting officer these added benefits would certainly exceed \$25 per vessel trip, or \$5,800.

48. To permit an analysis of the total project, as well as the parts remaining incompletd, estimates have been prepared of the benefits resulting from dredging of the 35-foot channel to the Tiverton waterfront. No benefits have been or will be realized by shipping to the central and upper harbor until a 35-foot entrance is provided as proposed under alternative Plans A or B. The Tiverton waterfront commerce is comprised entirely of petroleum and the benefits to this commerce are based on an estimated traffic over the life of the project 50 percent in excess of 1952 commerce. The benefits consist of savings in transportation

costs by elimination or reduction of tidal delays and by elimination of underloading. The waterfront channel also enables use of T-2 tankers to the Tiverton Lower Pool rather than the small tankers or barges that previously had to be employed owing to the controlling channel depth of 22 feet which existed prior to the improvement.

49. Additional tanker costs previously were incurred due to the necessity of having to remove part of the load at other northern Atlantic ports before sending the partially loaded tanker to the Gulf Wharf at Tiverton. This practice is estimated to have required the equivalent of eight hours additional time per vessel round trip. The benefit from elimination of this additional cost is estimated as follows:

$$8 \text{ trips} \times 8 \text{ hrs/trip} \times \$170/\text{hr} = \$10,900$$

Even underloaded these tankers would be subject to an average tidal delay of 4 hours. Elimination of this delay yields the following benefit:

$$8 \text{ trips} \times 4 \text{ hrs/trip} \times \$170/\text{hr} = \$5,400$$

The time required to transit the present waterfront channel to Gulf Wharf was compared to the time required by the former route via the mid-bay channel to Globe Wharf and then down the natural channel through Tiverton Upper Pool. The time for both routes was found to be about the same. Therefore, no benefit can be credited to the 35-foot project for savings in transit time to traffic moving to Gulf Wharf. In summation, the benefits to be realized from traffic to the Gulf Wharf area due to provision of the 35-foot waterfront channel amount to \$16,300.

50. Transportation savings in traffic to the Tiverton Lower Pool area have been made possible by the waterfront channel. These savings are due to present ability to use T-2 tankers in lieu of the small tankers

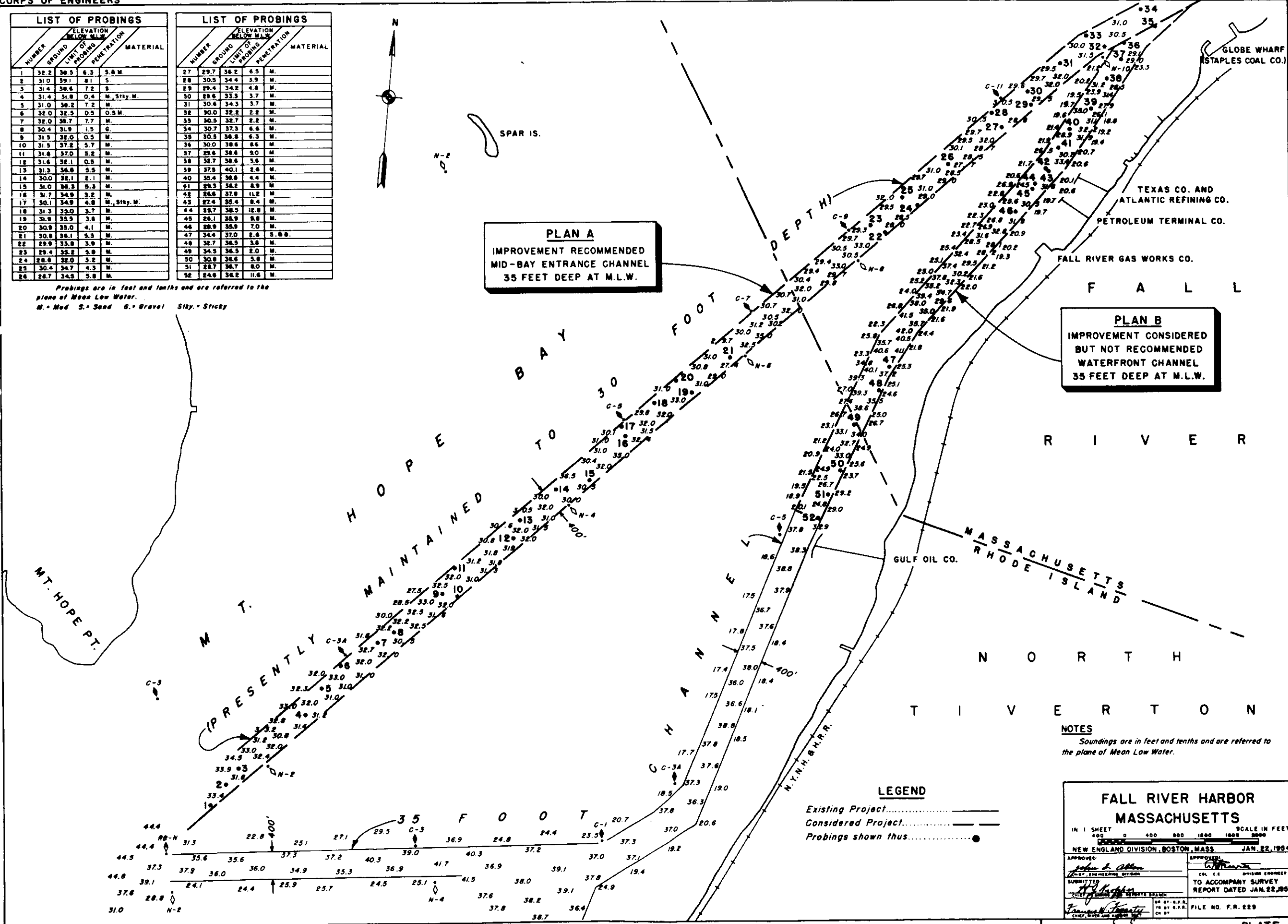
formerly used. The savings thus obtained, adjusted to future price levels, are estimated to equal about 8.5 cents a barrel or about 60 cents per ton. This saving is equivalent to a saving of about \$10,800 per fully loaded T-2 tanker. It is estimated that traffic over the life of the project will average 11 tankers per year giving a total annual benefit of \$118,800.

51. It was claimed by pilots that provision of a 35-foot anchorage south of Blades Ferry Bridge would reduce the loss in time awaiting favorable conditions for passing through the bridges. Such favorable conditions at the bridges are often missed owing to the present necessity of having to anchor below Hog Island. However, it is considered that this loss of a tide is due to having to navigate the 30-foot entrance channel at the higher tidal stages. Provision of a 35-foot entrance channel will enable deep-draft navigation at any stage of the tide, with only minor inconvenience, and prevent delays in a vessel's reaching the bridges at a time when conditions are satisfactory for passing through the draws. Therefore, it is considered that no benefit practicable of monetary evaluation would result from provision of the 35-foot anchorage.

52. The benefits estimated in the previous paragraphs are summarized as follows:

LIST OF PROBINGS					LIST OF PROBINGS				
NUMBER	GROUND	ELEVATION BELOW M.L.W.	LIMIT OF PROBING	MATERIAL	NUMBER	GROUND	ELEVATION BELOW M.L.W.	LIMIT OF PROBING	MATERIAL
1	32.2	36.5	6.3	S.M.	27	29.7	36.2	6.5	M.
2	31.0	39.1	8.1	S.	28	30.5	34.4	3.9	M.
3	31.4	36.6	7.2	S.	29	29.4	34.2	4.8	M.
4	31.4	31.8	0.4	M. Silty M.	30	29.6	33.3	3.7	M.
5	31.0	36.2	7.2	M.	31	30.6	34.3	3.7	M.
6	32.0	32.5	0.5	O.S.M.	32	30.0	32.2	2.2	M.
7	32.0	39.7	7.7	M.	33	30.5	32.7	2.2	M.
8	30.4	31.8	1.5	G.	34	30.7	37.3	6.6	M.
9	31.5	32.0	0.5	M.	35	30.5	36.8	6.3	M.
10	31.3	37.2	5.9	M.	36	30.0	38.6	8.6	M.
11	31.8	37.0	5.2	M.	37	29.8	38.4	8.6	M.
12	31.6	32.1	0.5	M.	38	38.7	38.4	0.3	M.
13	31.3	34.8	3.5	M.	39	37.5	40.1	2.6	M.
14	30.0	32.1	2.1	M.	40	35.4	39.8	4.4	M.
15	31.0	36.3	5.3	M.	41	28.3	34.2	5.9	M.
16	31.7	34.9	3.2	M.	42	26.6	37.8	11.2	M.
17	30.1	34.9	4.8	M. Silty M.	43	27.4	35.4	8.0	M.
18	31.3	35.0	3.7	M.	44	25.7	36.5	10.8	M.
19	31.9	35.3	3.4	M.	45	26.1	35.9	9.8	M.
20	30.9	35.0	4.1	M.	46	26.9	35.9	7.0	M.
21	30.8	36.1	5.3	M.	47	34.4	37.0	2.6	S. G.
22	29.9	35.8	5.9	M.	48	32.7	36.3	3.6	M.
23	29.4	35.2	5.8	M.	49	34.3	36.5	2.2	M.
24	28.8	32.0	3.2	M.	50	30.8	36.6	5.8	M.
25	30.4	34.7	4.3	M.	51	28.7	36.7	8.0	M.
26	28.7	34.5	5.8	M.	52	24.6	36.2	11.6	M.

Probings are in feet and tenths and are referred to the plane of Mean Low Water.
M. - Mud S. - Sand G. - Gravel Silty - Silty



PLAN A
IMPROVEMENT RECOMMENDED
MID-BAY ENTRANCE CHANNEL
35 FEET DEEP AT M.L.W.

PLAN B
IMPROVEMENT CONSIDERED
BUT NOT RECOMMENDED
WATERFRONT CHANNEL
35 FEET DEEP AT M.L.W.

NOTES
Soundings are in feet and tenths and are referred to the plane of Mean Low Water.

LEGEND
Existing Project.....
Considered Project.....
Probings shown thus.....

FALL RIVER HARBOR MASSACHUSETTS	
IN 1 SHEET 400 0 400 800 1200 1600 2000 SCALE IN FEET	
NEW ENGLAND DIVISION, BOSTON, MASS. JAN. 22, 1904	
APPROVED <i>John L. Collins</i> CHIEF, ENGINEERING DIVISION	APPROVED <i>W. H. H. H.</i> CHIEF, SURVEY DIVISION
SUBMITTED <i>W. H. H. H.</i> CHIEF, SURVEY DIVISION	TO ACCOMPANY SURVEY REPORT DATED JAN. 22, 1904
FILE NO. F.R. 229	

Summation of Benefits

<u>Par. Ref.</u>	<u>Item of Benefit</u>	<u>Tiverton Waterfront</u>	<u>Fall River South Waterfront</u>	<u>Fall River Central Waterfront</u>	<u>Fall River Upper Harbor</u>	<u>Total</u>
<u>Benefits</u>						
43,49	Reduction in tidal delays	5,400	-	8,700	62,900	
44	Reduction in transit time	-	-	400	2,200	
45,49	Eliminate need for underloading	10,900	-	-	47,200	
50	Use of T-2 tankers	118,800	-	-	-	
Benefits of Plan A				9,100	112,300	121,400
<u>Additional Costs *</u>						
46	Towing Service	-	-	9,800	-	9,800
46	Additional transit time	-	-	2,500	15,900	18,400
47	Safety	-	-	1,000	4,800	5,800
Total Additional Navigation Costs Due to Plan B		-	-	13,300	20,700	34,000
Net Benefits to Plan B		-	None	- 4,200	91,600	87,400
Benefits to completed waterfront channel at Tiverton		135,100	-	-	-	135,100

* Incurred by waterfront channel (Plan B);
not incurred by mid-bay channel (Plan A).

COMPARISON OF BENEFITS AND COSTS

53. Summarized below are the annual costs and benefits of (1) alternative 35-foot channels to the central and upper areas of Fall River Harbor (Plans A and B); (2) the completed 35-foot channel to the Tiverton waterfront; and (3) the desired 35-foot anchorage in the upper harbor:

	<u>First Costs</u>	<u>Annual Charges</u>	<u>Benefits</u>	<u>Ratio Benefits To Costs</u>
Plan A	\$2,306,000	\$90,700	\$121,400	1.34
Plan B	1,594,000	60,000	87,400	1.46
Increment Plan A over Plan B	712,000*	30,700	34,000	1.11
Tiverton Channel (Completed)	1,479,000	57,000	135,100	2.37
35-Foot Anchorage	1,436,000	55,600	None	-

* \$694,000 for dredging, \$18,000 for navigation aids

54. Plan A, in addition to benefits shown, is subject to other benefits which would increase the favorability of this plan, such as the encouragement of ship owners and operators to use the port, and the increase in the attractiveness of the port as a site for industries. The degree to which these intangible and unevaluated benefits would affect the choice of channel location is a matter of judgment.

PROPOSED LOCAL COOPERATION

55. No local cash contribution toward the cost of improvement should be required as the benefits to be derived are considered to be general in character. In view of the general metropolitan development around Fall River Harbor, it would be impracticable to require that the project be contingent upon local interests furnishing spoil disposal areas. The construction by the Commonwealth of Massachusetts of the State Pier,

nearing completion, affords a modern public terminal adequate to serve anticipated general commerce. Any Federal improvement or modification of the present project would require that local interests hold and save the United States free from damages due to the construction works.

COORDINATION WITH OTHER AGENCIES

56. All Federal, State and local agencies, interested in the development and use of waterways in general, and Fall River Harbor in particular, were advised of the public hearing which was held on April 30, 1953. The local and State interests from Massachusetts and Rhode Island, and their Congressional representatives, presented sharply divided opinions on the location of the channel. Massachusetts interests unanimously favor the deepening of the mid-bay channel to 35 feet. Rhode Island interests are unanimous in favoring abandonment of the mid-bay channel, and completion of the presently authorized 35-foot waterfront channel. Local pilot organizations and other navigation experts substantially support the improvement of the mid-bay channel. The Commonwealth of Massachusetts is willing and able to meet the requirements of local cooperation.

DISCUSSION

57. Fall River Harbor, the major port of southeastern Massachusetts, is the only one of the five New England ports with an authorized 35-foot project that has not been completed. It is one of the major petroleum receiving and distributing ports in New England and is the terminus of an oil pipeline serving central and eastern Massachusetts. The city is an important manufacturing center. Industries within the city and in the area tributary to it are dependent for their continued operation on the supply of fuel delivered over the waterway. Coal and petroleum products constitute about 98 percent of the total commerce handled in Fall River Harbor, including Tiverton, Rhode Island. These commodities are principally transported in vessels with drafts of 26 feet or more. Total commerce for Fall River Harbor for 1952 amounted to 1,876,643 tons. Port commerce has been increasing at an average annual rate of six percent since 1946. In view of the predominant part that petroleum plays in the total commerce of the harbor, and the steadily increasing use of this commodity, the volume of commerce is expected to continue to rise. The trend to larger ships is of more marked significance and importance than the increase in harbor tonnage. The use of vessels drawing 28 feet or over has more than tripled in the past six years.

58. Fall River at one time enjoyed the benefits of water-borne traffic in cotton, lumber, and general merchandise. At that time the area of terminal development was along the two miles of city waterfront immediately below the Slades Ferry Bridge. With the passage of time, the principal commodities became coal and petroleum, and the center of harbor activity shifted to the major power and fuel terminals above the bridges. The petroleum tank farms, with large space requirements, naturally located

at a distance from the heart of the closely built-up city waterfront. A second petroleum storage and distribution center also developed south of the city, particularly in Tiverton. This area was distant from the improved channels. Tankers and barges then in use were able to use the natural channels with depths of 22 to 25 feet leading to Tiverton waterfront terminals.

59. The report under review formed the basis for authorization in 1946 of the present 35-foot project in the harbor. Dredging was commenced in 1948 but was only partially completed at the request of Fall River interests to enable restudy of the entrance channel locations. The work completed consists of a 35-foot channel from deep water in Mount Hope Bay to the Gulf Wharf and other piers along the Tiverton waterfront, and completion, except for minor deficiencies, of the authorized work above Globe Wharf in Fall River. The work remaining to be completed consists of dredging to project depth approximately 1.75 miles of channel between the Gulf Wharf and Globe Wharf. The problem under study consists of the determination of the relative desirability of completing this section of channel as compared with a more direct entrance following the alignment of the former 30-foot channel.

60. At the public hearing held in 1953, Fall River interests requested the improvement of the mid-bay channel in preference to completion of the waterfront channel. They stated, in support of their request, that difficulties in navigating the authorized waterfront channel would serve as a deterrent to the successful operation of the two million dollar State pier now approaching completion. They further stated that the mid-bay channel would provide the most attractive port layout and encourage use of the new pier facilities by shippers in general cargo and lumber. They fur-

ther cited the difficulties inherent in the use of the waterfront channel by the deep-draft traffic that would traverse it enroute to the upper part of the main harbor. These difficulties, arising from poor alignment of the channel, its proximity to a steep shore, and adverse tidal currents, would be overcome if the mid-bay entrance location was improved.

61. Opposition to the relocation of the entrance channel was expressed by Rhode Island interests. That part of the waterfront channel within the State of Rhode Island has been completed, and existing and potential Rhode Island interests are therefor adequately served. Nevertheless, they evidenced concern that restoration of the mid-bay channel would entail abandonment of the completed Tiverton channel. No abandonment of the completed Tiverton channel is contemplated. A desire has been expressed for a turning basin adjacent to Gulf Wharf, should the mid-bay channel be authorized. However, there is sufficient area of natural deep water convenient to this wharf to enable free turning of tankers after they have been unloaded.

62. The present review has permitted a re-analysis of project economics on the basis of current costs and commerce. This economic analysis reveals that the costs for completing any further improvement of Fall River Harbor have risen sharply. This increase is due partly to the general rise in price levels experienced since construction on the project was initiated in 1949 and also to the interruption in project construction which necessitates demobilization and remobilization of large dredging plant. The annual commerce in Fall River Harbor has increased over 1,000,000 tons since 1944, the latest year included in the 1945 report under review. Present deep-draft commerce is already within 10 percent

of that anticipated in the 1945 study to result from the harbor improvement. Over 80 percent of the deep-draft commerce is destined to central and upper Fall River Harbor.

63. Two alternative plans for providing access to Fall River Harbor have been examined. Plan A provides for improvement of the harbor by provision of a 35-foot channel following the mid-bay alignment. The cost of this channel is estimated to be \$1,568,000, including aids to navigation. Adding the cost of \$738,000 for work completed or underway in the central and upper harbor, the total first cost of the plan becomes \$2,306,000. The annual cost is \$90,700 which when compared with annual benefits of \$121,400 gives a benefit-cost ratio of 1.34 for the plan. Plan B provides for the completion of the authorized waterfront channel at a cost of \$856,000. Adding to this the cost of work completed or underway in the central and upper harbor, the total first cost of a 35-foot channel from the Gulf Wharf at Tiverton to the head of the harbor would be \$1,594,000. Annual costs would equal \$60,000. Annual benefits under this plan would equal \$87,400 giving a benefit-cost ratio of 1.46.

64. The work accomplished to date at the lower end of the presently authorized project provides a channel 35 feet deep and 400 feet wide, widened at bends, from deep water in Mount Hope Bay to the Tiverton waterfront then northerly along the waterfront to opposite the Gulf Oil Company Wharf. This work has been completed at a cost of \$1,462,000. It affords adequate provision for the commerce in the area. The present review indicates that the benefits to this portion of the channel amount to \$135,100 annually as against annual costs of \$57,000, giving a benefit-cost ratio of 2.37. The channel at Tiverton is amply justified on its own account and should be maintained.

65. A comparison of the benefit-cost ratios for Plans A and B indicates that each plan is economically justified. Plan A is more

favorable from an economic viewpoint than Plan B, when due consideration is given to factors which can not be evaluated in monetary terms. The evaluated incremental benefits and costs are \$34,000 and \$30,700 respectively, for a benefit-cost ratio of 1.11. The final selection of a plan of improvement rests also upon other than evaluated factors. These factors include attractiveness of the port to ship owners and operators, and the desires of local interests.

66. The desires of Fall River interests, as expressed at the public hearing and expanded by consultation and correspondence, show marked preference for the mid-bay entrance channel as proposed in Plan A. They are expending \$2,000,000 in construction of a modern, public pier at the upper end of the straight mid-bay channel. The expert testimony of unbiased pilots indicates the superiority of the mid-bay channel. Local interests foresee no probable future development of the Fall River waterfront adjacent to the waterfront channel. The desires of Rhode Island interests are considered to be substantially met by maintenance of the completed part of the Tiverton channel.

67. The proposed construction of a 35-foot anchorage south of the bridge at an estimated cost of \$1,436,000 would be of assistance under present channel conditions to deep-draft shipping destined to the terminals above the bridges. This shipping now must navigate the mid-bay entrance channel, maintained to a depth of 30 feet, on the tide. However, upon dredging of either alternative entrance channel to a depth of 35 feet, this restriction will no longer exist, and the anchorage would lose its primary beneficial purpose.

CONCLUSIONS

68. It is concluded that a 35-foot mid-bay channel as described under Plan A would afford the most suitable entrance to Fall River Harbor. Under Plan A the mid-bay channel would be restored to the project and

deepened to 35 feet. The estimated cost of this improvement from present conditions, is \$1,540,000 with no additional cost for aids to navigation. The benefit-cost ratio of this plan is 1.34. The cost of Plan A in excess of the amount required to complete the existing project is \$694,000, and the benefit-cost ratio for this project modification is 1.11. The 35-foot channel to the Tiverton wharves has also proven to be adequately justified on its own merits and should be maintained.

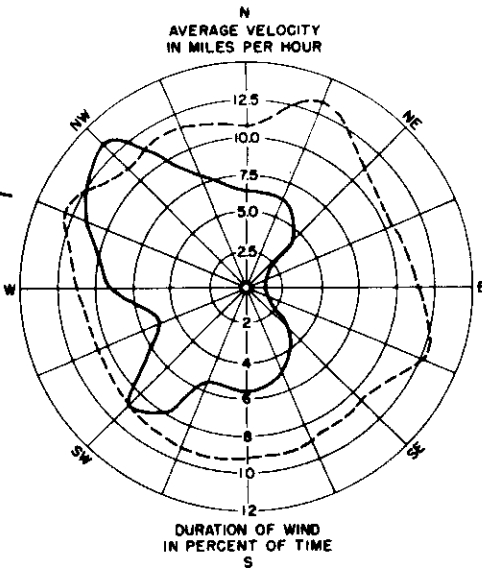
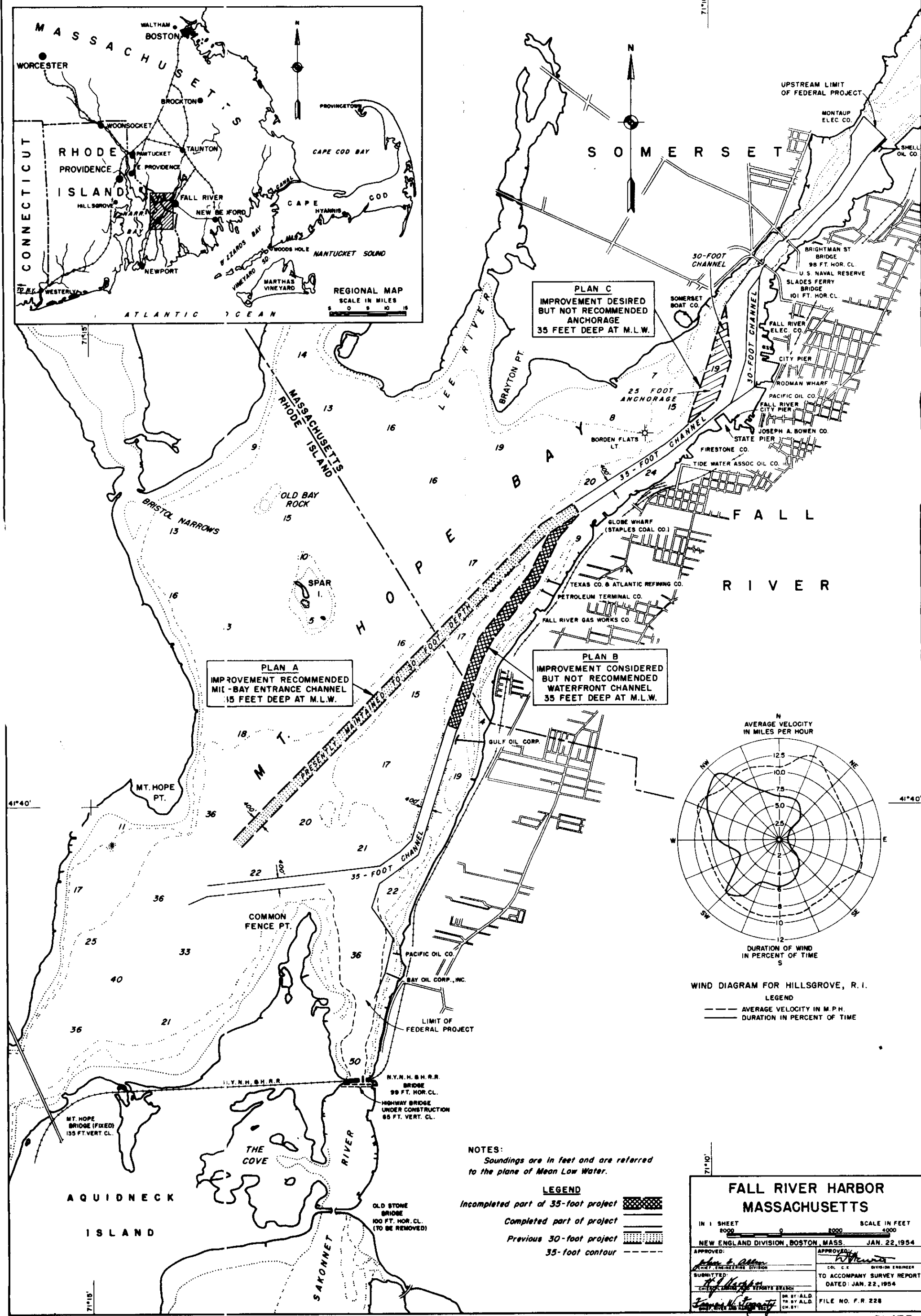
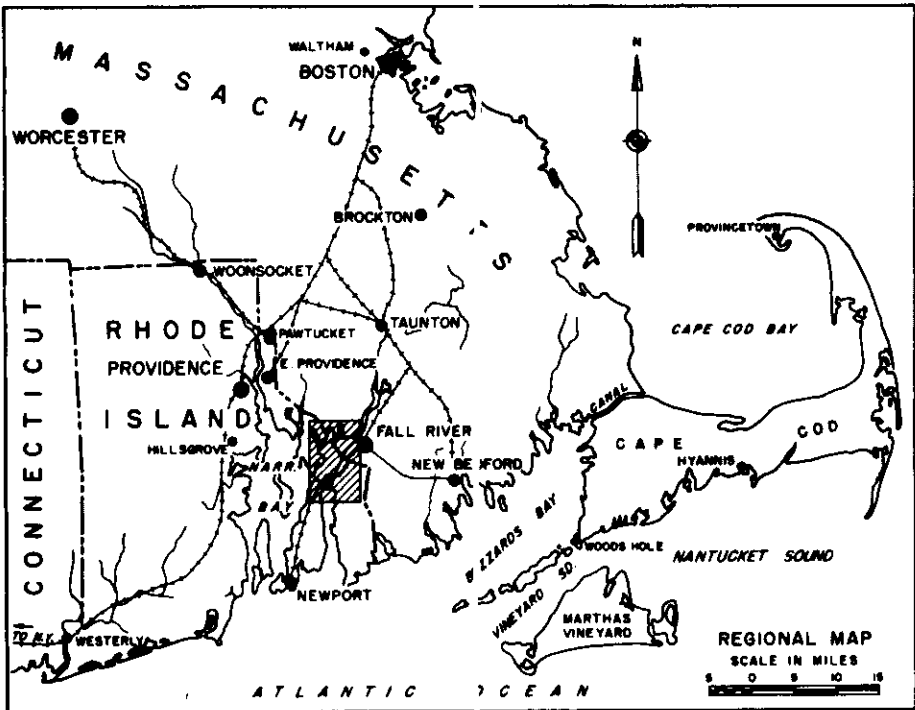
69. Provision of a 35-foot anchorage south of the Slades Ferry Bridge cannot be justified. Upon completion of a 35-foot entrance channel the need for the anchorage would be eliminated.

RECOMMENDATIONS

70. It is recommended that the existing project for Fall River Harbor be modified to provide for a channel 35 feet deep at mean low water generally 400 feet wide from deep water in Mount Hope Bay to the vicinity of Globe Wharf along the alignment of the former 30-foot mid-bay channel, ~~the~~ above described 35-foot channel to be accomplished in lieu of providing the authorized section of channel 35 feet deep along the Fall River waterfront between the vicinities of the Gulf Wharf and the Globe Wharf, with no change in other authorized channels and basins of the existing project; subject to the condition that no construction work on deepening of the mid-bay channel be accomplished until local interests agree to hold and save the United States free from damages due to construction and maintenance of the additional improvement. The estimated cost to the United States of this project modification is \$694,000 for new work with \$4,000 annually for maintenance in addition to that now required.

3 Incls:
Plates 1-3

L. H. HEWITT
Colonel, Corps of Engineers
Division Engineer



NOTES:
Soundings are in feet and are referred to the plane of Mean Low Water.

- LEGEND**
- Incompleted part of 35-foot project
 - Completed part of project
 - Previous 30-foot project
 - 35-foot contour

FALL RIVER HARBOR MASSACHUSETTS

IN 1 SHEET SCALE IN FEET 0 2000 4000

NEW ENGLAND DIVISION, BOSTON, MASS. JAN. 22, 1954

APPROVED: *[Signature]* DIVISION ENGINEER

SUBMITTED: *[Signature]* TO ACCOMPANY SURVEY REPORT DATED: JAN. 22, 1954

FILE NO. F.R. 228